CA2 ALID
1974B65

ALBERTA LEGISLATURE LIBRARY
3 3398 00332 3812

LIBRARY
VAULT 19

BRIEFING NOTES

ALBERTA PETROCHEMICAL INDUSTRY PROPOSALS FOR ENERGY COMMITTEE OF CABINET

VOLUME ONE

RECOMMENDATIONS AND SUMMARY

assembled by

ALBERTA DEPARTMENT OF INDUSTRY AND COMMERCE
EDMONTON

October 25, 1974

Digitized by the Internet Archive
in 2026 with funding from
Legislative Assembly of Alberta - Alberta Legislature Library

TABLE OF CONTENTS

CHAPTER 1. OBJECTIVES OF PETROCHEMICAL POLICY

CHAPTER 2. ETHANE AVAILABILITY

CHAPTER 3. ETHANE/ETHYLENE PIPELINE

CHAPTER 4. ETHYLENE MANUFACTURE

CHAPTER 5. FINANCIAL SUPPORT

CHAPTER 6. PLANT LOCATIONS

CHAPTER 7. LOCATION COST AND TIME AND LABOUR FACTORS

CHAPTER 8. ECONOMIC EFFECTS

CHAPTER 9. LABOUR SITUATION

CHAPTER ONE

OBJECTIVES OF PETROCHEMICAL POLICY

- as laid down by Premier Lougheed on September 6, 1974
  - GOALS OF THE GOVERNMENT:
    - "-- to diversify and become less dependent upon the sale of unprocessed resources --"
    - "-- to spread the growth on a balanced basis across the province --"
    - "-- to strengthen free enterprise in Alberta --"
    - "-- by upgrading the skills of our citizens to create higher productivity, greater income and more job satisfaction --"
  - ALBERTA'S INDUSTRIAL STRATEGY (AS IT AFFECTS PETROCHEMICALS) IS:
    - "-- to maintain continued pressure for fair market value for the sale of our natural resources."
    - "-- to use a portion of Government revenue as capital funds to encourage diversification and decentralization."
    - "-- to insist that our resources are - as much as practical - processed and upgraded in Alberta so that we do not export jobs with our resources. This is confirmed by our policy regarding petrochemicals - to use the feedstock to provide a basic plastic and other derivative industries here in this Province rather than in the Sarnia area."
- as stated by the Premier on May 16, 1974
  - "The two most promising areas for diversification and creation of new jobs in Alberta are in the areas of agricultural processing and petrochemicals."
  - "-- petrochemicals offers a promising opportunity for Alberta now!"
  - "Expansion of petrochemical facilities in Alberta is promising now because of the critical need - due to the large investment - of having a long-term assured source of feedstock which essentially means the by-products of natural gas or crude oil."
  - "The Alberta Government has concluded that the Alberta Gas Trunk Line - Canadian Industries Ltd. petrochemical complex deserves the priority endorsement and full support of the Alberta Government --"
  - "-- the Alberta Government is prepared to continue to support the Dow/Dome project --" provided that "-- if a major portion of the exported ethane or ethylene is diverted and held back in Canada as a result of Federal Government regulatory action then - despite pipeline economics - the upgrading and processing should be undertaken in Alberta where the resources are owned and secondary industry is needed and not create further concentration of population in central Canada."

Digitized by the Internet Archive
in 2026 with funding from
University of Alberta Library

https://archive.org/details/ableg_33398003323812

CHAPTER TWO

ETHANE AVAILABILITY

A. PHYSICAL AVAILABILITY OF ETHANE

The physical availability of ethane is summarized in the Table below

ESTIMATED CURRENTLY AVAILABLE VOLUMES OF ETHANE

LOCATION	AMOUNT**		DESTINATION
	shallow cut	deep cut*	
EMPRESS	19000 BPD	84000 BPD	mid-western U.S.A. Ontario
COCHRANE	16000 BPD	44000 BPD	north-western U.S.A. California
EDMONTON		21000 BPD	Edmonton area

* for technical reasons the minimum concentration of ethane in the extracted natural gas is around 1.5%.

** The Cochin pipeline will require 36000 BPD of ethane and each 1.2 billion lb/yr. ethane based ethylene plant will also require 36000 BPD of ethane.

The above data is agreed to by Dow, Dome and AGECL. The ERCB will announce its decision when its forthcoming Report on the availability of petrochemical feedstock is issued.

A number of opinions (Dr. Ryan, University of Alberta; ERCB; Dome Petroleum and Alberta Petrochemical Study) agree that there is at least sufficient ethane to supply the proposed Cochin line for 6 years, and two ethane based 1.2 billion lb/yr. ethylene plants for approximately 20 years.

B. LEGAL SITUATION

It is the opinion of the Department of Mines and Minerals that "The Province can control the production, sale and distribution of ethane from Crown leases as a consequence of the Crown's proprietary right in the leased substances, including ethane."

This view is supported by outside legal opinions and the Attorney General's Department.

Alberta and Southern believes there is a possibility of reaching an agreement to have ethane removed from their gas, providing:

(i) they receive "fair market value" for their ethane; and,

(ii) replacement gas can be made available to cover the loss in BTU's.

LEGAL SITUATION (continued)

Trans Canada Pipelines shares the Alberta and Southern view except that they may have difficulty in revising some of their 1000 BTU contracts with their customers.

It appears to be reasonable to expect the NEB to allow export permits to be changed to allow increased export volumes, providing the number of BTU's exported, remains constant.

NOTE: The Department of Mines and Minerals believes however that:

> "The Province cannot control the sale and distribution of ethylene, or any other substance manufactured directly or indirectly from ethane, outside the confines of the Province."

C. PROPOSED MECHANISMS TO CONTROL ETHANE EXTRACTION ETC.

Possible mechanisms are:

- "by corporate agreement between the Crown and existing purchasers of natural gas;
- via the Crown's right to take its royalty in kind under the existing provisions of P. & N. G. Leases;
- by reserving ethane from the disposition granted the lessee (which requires abrogating existing contracts);
- by establishing a marketing board or similar mechanism along the lines of the B.C. Petroleum Corporation."

SUPPORTING DOCUMENTS

- see Volume Two, Chapter Two

1. "Alberta Ethane"
2. "Alberta NGL Sources and Dome et al NGL Supply System" (Dome Petroleum Co.)
3. "September 24, 1974 Meeting with Alpec Consortium Members"
4. Dr. Mellon's letter of October 25th "Legal and Constitutional Aspects of Ethane Extraction and Control." (Department of Mines and Minerals).

CHAPTER THREE

ETHANE/ETHYLENE PIPELINE

- the arguments for and against the proposed Cochin Pipeline Company's line are presented in the attached Table.

THE PIPELINE PROPOSAL

- Dow Chemical of Canada Ltd., and Dome Petroleum Ltd. will each have a 50% interest in the Cochin system - Pan Canadian Gas Products has an option to acquire a 20% interest and other companies (i.e. ethane owners and Alberta Energy Co.) may be invited to participate.

- Cochin has ERCB, Alberta Government, NEB and Federal Government approval to build a 12" diameter pipeline from Empress, Alberta to Green Springs, Ohio and Sarnia, Ontario, and a permit to export an average of 36,000 BPD of ethane from 1976 to 1983 to the U.S.A.(but the initial design throughput will be 95,000 BPD of ethane; the optimum maximum will be 150,000 BPD).

- the line could also transmit gaseous and liquid hydrocarbon products, benzene, ammonia, etc. and other non-corrosive materials.

- the line would be a common carrier, with transmission tariffs set by the NEB (on the Canadian Section) based on a 30 year line life.

- the line is estimated to cost $210 million and would be financed by 25% equity and 75% debt.

- 50% of the profits would accrue equally to Dow and Dome, 20% to the owners of the ethane extraction rights and 30% to Alberta users of ethylene.

ACTION REQUIRED BY ALBERTA GOVERNMENT

- if it is desired that the Cochin line be proceeded with, the Government of Alberta will be asked:

  - to give general support to all phases of the pipeline project (i.e. both ethane extraction and Cochin Line);

  - to order the extraction of ethane at full recovery rates from natural gas at Empress and Cochrane in accordance with the provisions of the applicable gas removal permits;

  - to co-operate in acquiring make-up gas to replace shrinkage caused by ethane removal, as well as the loss in BTU values.

MEMORANDUM OF UNDERSTANDING

- the salient points of the Dow-Dome-AGTL Memorandum as it affects the Cochin Pipeline are:
  - ethane shipment is covered by an 8 year agreement;
  - ethylene shipment is covered by a 20 year agreement;
  - Dow would ship 200 million lbs. of ethylene from the first ethylene plant to Sarnia; and 200 million lbs/yr. from the second plant
  - AGEC will either commit to ship 100 million lbs. of ethylene from the second plant to Sarnia, or sell that amount to Dow for movement through the line i.e. total ethylene throughput will be 500 million lbs. annually.

SUPPORTING DOCUMENTS

- see Chapter Three, Volume Two.
- "Memorandum of Understanding"
  - includes a description of the Cochin pipeline.

PROS AND CONS OF THE PROPOSED COCHIN/DOME PIPELINE

PRO-PIPELINE

1. The Cochin pipeline is the condition for Dow involvement in Alberta. Dow's deadline for ethylene start-up is fall 1977. Compressors have been on order for one year and engineering is complete for the ethylene plant at Fort Saskatchewan.

2. Provides operating flexibility for Alberta ethylene plants in times of derivative plant upsets, by providing a temporary alternative user of ethylene down the pipeline.

3. Optimum ethane recovery from gas leaving Alberta, with ethane sales in Eastern Canada/U.S. as a premium fuel, and profits shared by Alberta gas and ethylene producers.

4. If ethane extraction facilities are in place in Alberta, and the northern gas pipeline passes through Alberta, could be utilized to recover ethane from this gas.

5. Could use line to ship surplus petrochemicals to Eastern Canada [at the minimum would mean upgrading of ethane (as fuel) to ethylene]. Permitted ethane volumes (for first six years) and ethylene shipments (at 400-500 million lbs/yr.) will not utilize line to full capacity. Hence other volume commodities could be shipped east, cheaply.

6. Full ethane recovery, and ethane pipeline shipments from Alberta would prevent ethane recovery down the line.

7. If ship ethane/ethylene will have maximum foreknowledge of Eastern Canada demand situation, thereby enabling Alberta derivative manufacturers to expand in the hope of forestalling the construction of new derivative plants in Eastern Canada.

ANTI-PIPELINE

1. AGECL's deadline for ethylene plant start-up is fall 1977. Compressors have been on order since summer 1974 and engineering is well advanced. Hence lack of Dow participation in Alberta will not delay ethylene project.

2. It is not easy to sell spot shipments of ethylene.

3. Optimum ethane recovery creates legislative/legal problems re: ethane ownership, interprovincial trade, natural gas volume makeup and BTU makeup.

4. Pro-argument trivial, because it's too problematical.

5. Such shipments could be at the expense of further upgrading in Alberta, and the further development of a petrochemical industry in the Province.

6. Such recovered ethane could only be used for fuel purposes (unless the Province concerned subsidized the ethane costs for petrochemical manufacture).

7. Since there is little likelihood of increased ethylene capacity in Eastern Canada after Petrosar (offshore crude too expensive; market for crude oil cracking products will be saturated in Ontario after Petrosar; Petrosar can't expand economically beyond currently planned 1.0 billion lb/yr. capacity; ethylene not likely to be imported from U.S.) if there is no pipeline, additional Canadian derivative demand would have to be supplied from Alberta plants.

PRO-PIPELINE	ANTI-PIPELINE
8. Ethylene surplus to derivative manufacturers needs in the early start up years can be shipped cheaply to Eastern Canada.	8. See 2. on previous page. Also, ethylene plant will not be on full stream until its third year of operation, and during this time there is a forecasted shortage of ethylene for conversion to derivatives. Hence, in fact, ethylene shipments in the pipeline will be at the expense of derivative manufacture in Alberta (short term situation).
9. Alberta has been striving for 70 years to obtain low transportation rates for its products to the rest of Canada. It now has the chance to do this for upgraded hydrocarbon products and bulk petrochemicals.	9. Alberta now wants to upgrade its resources locally. In the absence of the pipeline, further upgrading is more likely to take place here. If the pipeline exists, pressure could be brought by the Federal Government to ship these less than optimally upgraded resources east so as to "better balance" industrial development across Canada.
10. Alberta has a commitment to help Eastern Canadian plants to expand to world capacity.	10. If the pipeline exists, Alberta may not have the power to prevent the transmission of pipeable products to Eastern Canada, i.e. the Alberta Government may not have the power to control the nature and volume of pipelined products or the use to which they would be put.
11. Pipeline owners claim that they are taking a risk, but that the Government is not. Note that the ERCB has issued a permit, allowing Dome to export, and this has been ratified by Order in Council.	11. The Dome ethane export permit is for ethane exports for 6 years only. Alberta Government may be faced with a future decision as to what should go down that line.
12. Condition is desirable. Since 6 years of ethane shipments can't pay for the line, it is necessary to have some long term volume shipments (which could be ethylene for example, at 400-500 million lbs/yr. for 20 years) to help pay for the line.	12. A condition of the NEB ethane/ethylene permit to Dome is that ethylene would be shipped through the line(because it is in the public interest to do so).
13. If pipeline exists, it gives companies wishing to make new investments in Canada, an optimum choice of plant location (i.e. near markets or near raw material supply).	13. An Alberta location is not particularly attractive on economic grounds, however companies consider locating in Alberta because of strategic considerations. Existence of a pipeline would decrease the importance of this consideration.
14. Argument is trivial. It would be desirable to fill the line.	14. Present proposal is for Dow to ship ethylene via Cochin Line to Sarnia. However, there can probably be no discrimination in favour of Dow, therefore other companies requesting to ship ethylene east, will probably have to be allowed to do so. Furthermore, the Alberta Government probably does not have the authority to make agreements with companies, that they would not ship their products to Eastern Canada.

/3

PRO-PIPELINE

15. The steel pipe has already been allocated and much of it delivered. Many of the valves and pumps are coming from the U.S. and don't affect the Canadian steel situation. Much of the labour will come from outside Alberta.

17. If the Province must support a low price of ethane for petrochemical manufacture, it would do better to sell the ethane as fuel rather than as chemicals.

18. Because of the manner in which it is proposed to distribute pipeline profits, ethylene manufacturers/users will have lower manufacturing costs, than in the absence of the pipeline.

19. Petrosar has not yet obtained its feedstock requirements. If a pipeline is in place, Alberta has a chance to provide Sarnia with chemicals that would otherwise be made by Petrosar.

ANTI-PIPELINE

15. The pipeline and associated ethane extraction plants will require substantial quantities of labour, pipe steel, pumps, valves, etc. adding to the problems of an already tight labour market, and steel shortage situation.

16. Ethylene committed to Sarnia is not available for upgrading in Alberta (permanent situation).

17. In order to maintain a viable ethane based petrochemical industry in Alberta, Alberta must "support" the ethane and/or ethylene price. Hence, if these commodities are shipped out of the Province, the people of Alberta will be subsidizing industry in other provinces.

18. The profits from the pipeline, in the most probable case, will be 0.26 cts/lb. of ethylene (see page 5 - 4) vs. the support price required of 1.5 cts/lb. (if only one ethylene plant is built - if two plants are built the profit distribution will be 0.13 cts/lb.).

19. This proposal would result in Alberta selling basic petrochemicals instead of crude oil, to Sarnia - but doesn't help to achieve further upgrading in Alberta.

CHAPTER FOUR

ETHYLENE MANUFACTURE

INTRODUCTION

- at present in Alberta, because the engineering is completed and equipment has been on order since October, 1973, the ethane route to ethylene is the most desirable one
  - lowest capital cost route
  - most resource efficient if ethylene is the only product desired
  - an increase of 27 cts/MCF in natural gas price is equivalent to a 1 ct/lb. increase in the cost of ethylene.

  NOTE: The policy of increasing the price of natural gas to its BTU value relative to crude oil is directly contrary to the policy of establishing a gas based petrochemical industry in Alberta.

- naphtha from crude oil (and possibly condensate from natural gas) is the most desirable feedstock for ethylene manufacture if a market can be found for the co-products (i.e. propylene, butadiene, benzene, xylene, etc.)
  - the price of the resulting ethylene can be varied somewhat depending on whether the refiner wishes to take his profit on naphtha or the other crude oil fractions, or on ethylene or the other chemical products (e.g. Petrosar).

  NOTE: The world-wide trend is to using the least expensive fraction of the crude oil barrel for petrochemical manufacture.

- the Alberta interest in ethylene arises because it is a basic petrochemical building block capable of being converted to a wide range of products having varying uses, by a wide number of companies (see accompanying Table of companies which have shown a firm interest in Alberta).

- such a range of products, if converted to the final consumer product in Alberta, would give our entrepreneurs many new manufacturing opportunities.

THE DOW-DOME-AGTL MEMORANDUM OF UNDERSTANDING

In summary the Memorandum agrees that:(as regards ethylene manufacture only):

- extraction plants to recover ethane from natural gas to be built at Empress, Cochrane and Edmonton in quantities to satisfy existing Dome export permits and Alberta ethylene manufacturing needs.

THE DOW-DOME-AGTL MEMORANDUM OF UNDERSTANDING (continued)'

- Dome and AGTL will set up a joint company to gather and market the ethane (in which Alberta Energy Company may acquire a one third interest);
- this marketing company will own and operate any ethane extraction facilities which the owners of the ethane do not wish to construct;
- all ethylene will be manufactured by AGECL;
- two 1.2 billion lb/yr. plants would be completed by January 1, 1980;
- Dow would supervise design, construction and start-up of the plants and assist AGECL in initial operations;
- pipeline facilities to distribute ethylene in Alberta would be installed and operated by AGECL.

NEED FOR

ERCB HEARINGS

- the Energy Committee has examined the ethane/ethylene situation in some detail - it is unlikely that an ERCB hearing would elicit substantially more information than is available now, and it would take substantial time,
- for a second ethylene plant however, it is not so clear that ethane should be the raw material
  - due to the recent rise in gas prices
  - due to Dow's early need for benzene
- hence an ERCB hearing on a second ethylene plant may be in order
- an ERCB hearing on the distribution of ethylene (and co-products) to potential derivative manufacturers, from a second ethylene plant may be in order to bring out
  - the ethane/naphtha alternatives under study in AGTL
  - the HBOG, Mannix and Mitsubishi proposals
  - Du Pont's apparent attempts to gain a monopoly in HDPE and polypropylene
  - the Du Pont-Hoechst situation
  - market forecasts for ethylene and benzene derivatives.

SUPPORTING DOCUMENTS

- Dow-Dome-AGTL "Memorandum of Understanding"

see Chapter 3, Volume II

PETROCHEMICAL DEVELOPMENT

ETHYLENE FROM ETHANE PLANT NO. 1 (a)

Start up - On or before January 1978

COMPANY	PRODUCT	RAW MATERIAL USED	CAPACITY
Alberta Gas Ethylene Co.	Ethylene	Ethane	1.2 billion lbs/yr.
DuPont of Canada Ltd.	High Density Polyethylene	Ethylene	300 million lbs/yr.
Canadian Industries Ltd.	Low Density Polyethylene	Ethylene	440 million lbs/yr.
Dow Chemical of Canada Ltd.	Vinyl Chloride Monomer (b)	Ethylene Chlorine	700 million lbs/yr.

NOTES

(a) Proposal calls for Dow to ship 100/200 million lbs. of ethylene to Sarnia by pipeline.

(b) Dow and/or B. F. Goodrich may undertake this development. Diamond Shamrock and/or B. F. Goodrich are expected to manufacture polyvinyl chloride from this monomer.

PETROCHEMICAL DEVELOPMENT

ETHYLENE FROM ETHANE PLANT NO. 2 (a)

Start up projected - On or before January 1980
Ethylene capacity - 1.2 billion lbs/yr.

Disposition of ethylene not firmed, but could be as follows:

New Plants

- Canadian Hoechst Ltd. producing 170 million lbs/yr. vinyl acetate
- Japan Catalytic/C. Itoh producing 170 million lbs/yr. ethylene glycol

Expansions

- DuPont of Canada - expand high density polyethylene
- Canadian Industries Ltd. - expand low density polyethylene

Shipment to Sarnia

- Dow would ship 400 million lbs/yr. of ethylene to Sarnia
- 100 million lbs/yr. of ethylene would be shipped on Alberta Gas Ethylene's account to eastern Canada

NOTES

(a) Whether this plant would be built will depend on the prices of ethane relative to other feedstocks.

PETROCHEMICAL DEVELOPMENT

PROJECT:	Petrochemical refinery
PROPOSED BY:	Alberta Gas Trunk Line
START UP:	1978/81
FEEDSTOCK:	Crude oil (100,000 bbls/day)
PRODUCTS:	ethylene propylene butadiene benzene xylene toluene fuel oils, gasoline etc.

PETROCHEMICAL DEVELOPMENT

PROJECT:	Condensate Cracker
PROPOSED BY:	Hudson's Bay Oil and Gas
POSSIBLE PARTNERS:	DuPont of Canada Union Carbide
START UP:	1981
FEEDSTOCK:	Condensate (36-42,000 bbls/day)
PRODUCTS:	ethylene propylene butadiene benzene xylene toluene fuel oils

PETROCHEMICAL DEVELOPMENTS

(OTHER)

PROPOSED BY	PROJECT
Loram Ltd.	petrochemical refinery based on crude oil (producing ethylene, propylene, butadiene, benzene, xylene, toluene and fuel oils etc.)
Mitsubishi Petrochemicals	production of benzene or benzene and toluene from condensate (30,000 to 42,000 bbls/day)

CHAPTER FIVE

FINANCIAL SUPPORT

This chapter is concerned with financial support requested by companies in order to maintain competitive raw material costs and to eliminate the effect of high construction costs relative to the Gulf Coast. It is not concerned with costs associated with plant locations at environmentally desired sites.

AGECL Proposal

The Alberta Gas Ethylene Company is proposing to manufacture and supply ethylene to derivative plants in Alberta at a price which will allow them to compete with other derivative manufacturers in Eastern Canada and the United States.

The total capital investment is estimated to be $285 million and is detailed as follows:

Fixed Capital Investment	$199.00 million
Preproduction and start up costs	17.75 million
Interest during construction	46.25 million
Working Capital	22.00 million
TOTAL	$285.00 million

The proposed capital structure is as follows:

35% medium term debt at 10% interest	$ 99.75 million
40% long term debt at 11% interest	114.00 million
25% common equity at 20% after tax return	71.25 million
TOTAL	$285.00 million

Based on the recently negotiated Pan-Alberta gas contract (81¢ per MCF in 1978) the cost of producing ethylene in Alberta from 1978 to 1984 breaks down as follows. Natural gas prices are assumed to increase at 5% annually, from the 81¢ price.

AGECL COST OF SERVICE ETHYLENE PRICE (¢/LB.)

YEAR	ETHANE COST	OPERATING COSTS	CAPITAL CHARGES	ETHYLENE TRANSPORTATION	TOTAL COST
1978	5.3	2.2	5.9	0.3	13.7
1979	4.3	1.8	4.5	0.2	10.8
1980	3.9	1.8	3.9	0.2	9.8
1981	4.0	1.8	3.8	0.2	9.9
1982	4.2	1.9	3.7	0.2	10.1
1983	4.5	2.0	5.2	0.3	12.0
1984	4.6	2.1	4.9	0.3	11.9

AGECL Support Requirements and Exposure

1. AGECL must be assured of a sufficient supply of ethane and natural gas to support the production of 1.2 billion pounds of ethylene over a 20 year period.

2. AGECL requires assurance that it will be protected from the effects of natural gas reaching the equivalent price of crude oil on an energy basis.

3. AGECL and the derivative companies have indicated that Alberta ethylene must be available at a price approximately 1.5¢/lb. below the Gulf Coast price. This differential has been assumed to escalate at 5% annually after 1978. To meet this commitment AGECL's operation would show a subsidy requirement of the magnitude shown in the following Table when compared to probable and pessimistic estimates of the Gulf Coast ethylene prices. The following table is based on the price of natural gas being 81¢/mcf in 1978 and escalating at 5% annually thereafter.

AGECL SUBSIDY REQUIREMENTS*

Year	Probable Case	Pessimistic Case
1978	$22.7 million	$35.3 million
1979	none	16.2 million
1980	none	7.2 million
1981	none	3.6 million
1982	none	1.2 million
1983	none	20.4 million
1984	none	16.8 million

*see text for explanations and conditions

AGECL have indicated that where possible, such as in the probable case, any required subsidy would be regarded as a loan and would be repaid in the following years by effectively applying a surcharge to the derivative companies when AGECL's ethylene price is more than competitive with Gulf Coast competition. This of course is not possible if the pessimistic view of Gulf Coast ethylene prices is realized.

The government, if it agreed to support AGECL by advancing cash when deficits occur, would see a maximum financial exposure if natural gas prices rise to an energy equivalent value with heating oil in the energy market place. This would mean a field price in Alberta of approximately $1.25 per MCF in 1978 escalating at 5% annually thereafter. This is based on an Alberta field crude price of $8.00 in 1978. As a result AGECL would incur the deficits shown in the following Table.

AGECL DEFICITS IF GAS PRICES RISE TO BTU EQUIVALENT TO CRUDE OIL

Year	Probable Gulf Coast Ethylene Price	Pessimistic Gulf Coast Ethylene Price
1978	$42.2 million	$49.0 million
1979	13.0 million	34.7 million
1980	none	28.8 million
1981	none	26.3 million
1982	none	25.0 million
1983	9.4 million	45.4 million
1984	7.0 million	43.0 million

After the initial start-up year AGECL can come fairly close to competing with the probable forecast of Gulf Coast ethylene prices but would require massive subsidies if lower Gulf Coast prices prevail.

Derivative Plant Proposals

The 1.2 billion pounds of ethylene would be utilized by Du Pont of Canada Ltd., Canadian Industries Limited and Dow to produce high and low density polyethylene and vinyl chloride monomier. Capital requirements and capital structure have been proposed as follows:

	Du Pont	CIL
Debt	$120 million	$139.2 million
Equity	30 million	36.0 million
Preferred Shares	none	64.8 million
TOTAL CAPITAL	$150 million	$240 million

Both companies have offered Alberta a 30 percent share of the equity. Both companies have also proposed that the Alberta Government supply the debt capital. Repayment of the debt and the interest on the debt would be according to some formula which will allow these companies to operate profitably in view of the extraordinary costs which they expect to incur.

The status of proposals made by B. F. Goodrich, Canada; Hoechst, Canada; and Japan, Catalytic Chemical Company is unclear at this stage.

Dow Chemical of Canada

Dow Chemical has not asked for any assistance to date in support of its VCM Plant. This is probably because:

-- they assume they will locate on their existing Fort Saskatchewan plant site, thereby incurring relatively low capital costs;

-- they have obtained a substantial number of gas wells and hence can distribute their profits between gas production and chemicals as they wish;

-- they will obtain 25% of the profits of the proposed Cochin pipeline if the line is approved;

-- they propose to sell all their derivatives manufactured in Alberta, to Alberta users and hence --- unlike the other proposed derivative manufacturers --- will not be competing in Eastern markets.

Distribution of Cochin Profits

Cochin Pipelines proposes to distribute to Alberta ethane users 30% of net income from ethane sales. At a natural gas value of 75¢/million BTU, a crude oil price of $8.00/bbl., and an export volume of ethane of 35,000 bbls/day, this benefit to ethylene manufacturers would amount to about 0.26 cents/lb. ethylene provided there was one 1.2 billion lb/yr. ethylene plant in operation and 0.13 cents/lb. ethylene if two 1.2 billion lb/yr. ethylene plants existed. This "benefit" changes with increases in gas price, crude price and pipeline tariff.

Alternative Possible Guidelines for Financial Support

(a) Ethylene manufacture

- maximum ethane price to Alberta Gas Ethylene Co., could be based on a natural gas price approximately 20¢ per MCF lower than the field price of gas resulting from an equilization of energy prices in the market. Undertaking could be maintained for 20 years but would not apply if AGECL's return on equity exceeds 20%.

- consistent with other provisions presented under this section, the Government could undertake to provide assistance to AGECL sufficient to maintain for example a 10% after tax return on equity in any given year.

- assistance should be limited to for example the first 8 years of plant's operation.

- maximum amount of assistance to be paid to AGECL in any one year could be limited for example to an amount not to exceed the royalties on the amount of gas used by the ethylene plant.

(b) Derivatives manufacture

- the Alberta Government could agree to participate in the debt financing of the companies of the outstanding debt at for example, market interest rates.
- the Alberta Government or its designates could request an option to acquire equity in these companies up to a specified maximum.
- the Alberta Government could be prepared to advance short term loans on an "as needed basis" to derivative companies only, to cover the lower returns which will be realized from heavy export sales in the first three years.

CHAPTER SIX

PLANT LOCATIONS

--- plant location factors, as considered by companies and the Government are outlined on the attached Table One.

Oil Sands Corridor Study

--- an examination of the Study report indicates that factors concerning the location of petrochemical plants were not investigated by the Study group;

--- hence the petrochemical plant sites recommended by the study are not supported by any of the evidence presented.

Individual Plant Site Locations

--- these are summarized on the attached Table Two and the accompanying notes.

TABLE ONE

SITE LOCATION

FACTORS CONSIDERED BY COMPANIES	FACTORS CONSIDERED BY GOVERNMENT
1. Near adequate water, electric power, and sewage services, good living accommodation (for employees), amenities (for employees), educational and hospital facilities (for employees). i.e. minimum offsite costs, maximum existing infrastructure.	1. One not leading to further industrial concentration or population concentration.
2. Flat well drained site, with stable ground.	2. Not on class 1, 2 or 3 agricultural land
3. Access to raw materials easy access to transportation.	3. Plant emissions to meet stated environmental criteria.
4. Access to transportation, to receive raw materials and components, to ship products. Ready access to major public transportation.	4. Location to meet provincial plant site dispersion policies, thereby strengthening the property tax base in the smaller centres, as well as employment opportunities there.
5. Ready access to labour market -- both quality, quantity and dependability.	
6. Ready access to supporting services e.g. machinery parts supply, maintenance, professional services, etc.	
7. Economic benefits of expanding on existing plant sites. Ability to expand on a proposed site.	

COMPANY SITE LOCATIONS

COMPANY	PRODUCT	SITE LOCATION		
		COMPANY CHOICE	INDUSTRY & COMMERCE RECOMMENDATION	ENVIRONMENT RECOMMENDATION
AGEC (1)	ethylene from ethane (two plants)	N. W. Bruderheim	N. W. Bruderheim	15 miles east, Red Deer
AGTL	ethylene from crude oil	Skaro	Skaro	Skaro
CIL (3)	polyethylene (low density) (LDPE)	existing Edmonton plant site	Edmonton	1. Edmonton; but no further expansion beyond 450 million lb/yr. proposal (4) 2. Further expansion, Skaro.
DOW (2,3)	vinyl chloride monomer (VCM) styrene	existing Fort Sask. plant site Skaro (?)	Fort Saskatchewan Skaro	Fort Saskatchewan Skaro Skaro
Du Pont	polyethylene (high density) (HDPE)	next to AGEC	next to AGEC	Skaro
B. F. Goodrich	polyvinyl chloride (PVC)	Edmonton Fort Saskatchewan	1. If VCM/PVC, Skaro (5) 2. If PVC only - then locate next to another firms VCM plant (5)	Skaro
Canadian Hoechst	vinyl acetate (VA)	Edmonton or Fort Saskatchewan	next to AGEC	15 miles east, Red Deer
Japan Catalytic Chemical Co.	ethylene oxide/ glycol (EO/EG)	Edmonton or Fort	next to AGEC	15 miles east, Red Deer

NOTES

(1) - AGEC is concerned over the volume of water available on the Red Deer River (even when a dam is installed) for two ethylene and the associated derivative plants.

(2) - Dow own their own salt (the raw material for caustic/chlorine manufacture) on the Fort Saskatchewan site --- would have to pay 40¢/ton royalty at any other location (caustic/chlorine plant now produces 350 tons chlorine/day, to be expanded to 1,200 tons/day for VCM plant --- 1 ton of salt equivalent to 1 ton of chlorine) have permits under Clean Air and Clean Water Acts to construct and operate an ethylene plant at the Fort Saskatchewan site (expire May 9, 1975). These permits would not be valid for the VCM and styrene plants. Site does not meet current land-use requirements. Note that VCM manufacture requires chlorine, and chlorine is dangerous to ship in large volumes, therefore a VCM plant must be adjacent to a caustic/ chlorine plant

(3) - Dow and CIL would achieve significant capital and operating cost savings if located on their existing plant sites.

(4) - CIL expansion restriction at Edmonton site due to forecasted saturation of the local airshed.

(5) - due to the highly noxious nature of VCM, a PVC plant should be adjacent to a VCM plant.

Supporting Documents (See Volume II, Chapter Six)

1. Letter from Mr. Thiessen (Department of the Environment) to Mr. McDonald, dated October 21st.
2. Clean Air and Clean Water permits for Dow.

CHAPTER SEVEN

LOCATION COST, TIME AND LABOR FACTORS

Site Location Factors

-- plant site location factors were discussed in the last chapter.

-- some of the higher costs faced identified by one company are listed below with differential cost estimates between Skaro and Bruderheim.

DIFFERENTIAL SITE COSTS IDENTIFIED BY AGECL

	Item	Cost*
1.	Capital Cost Penalty	$15.65 million
2.	Construction Labor Penalty for Ethylene Plants	6.0 million
3.	On-going Capital Additions	0.37 million
4.	Higher Operating Labor Costs	7.82 million
5.	Higher Maintenance Costs (Travel Time Subsidies)	1.751 million
	TOTAL PENALTY	$31.59 million

* AGECL estimates (for a five year period Items 3 - 5) for relocation of two ethylene plants and the associated derivative plants from Bruderheim to Skaro.

In addition CIL has estimated that the economic penalty associated with expansion of their operations at Skaro rather than Strathcona would be approximately $30 million.

The following costs have been estimated for the creation of a new town capable of handling the work force of a chemical complex directly employing 1,620 persons with a total town population of approximately 16,000*.

*Department of Municipal Affairs estimates for Community Infrastructure Costs. See Appendix I for details.

ESTIMATED COSTS FOR CREATING A NEW PETROCHEMICAL TOWNSITE

Item	Total Cost	Estimated Provincial Share
Airport	$ 1.0 million	$ 0.5 million**
Railroad	2.5 million	2.5 million
	-3.9 million	-3.9 million
Highways	0.6 million	0.6 million
	-0.8 million	-0.8 million
Pipeline	0.5 million	0.5 million
Residential Lot & Servicing	29.7 million	29.7 million
Water & Sewage	9.8 million	9.8 million
Hospital	7.0 million	7.0 million
Schools	16.0 million	16.0 million
Land Costs	1.6 million	1.6 million
Internal Arterial Roads	9.0 million	9.0 million
Recreation	10.0 million	10.0 million
TOTAL EXPENDITURE	$ 87.7 million	$ 87.2 million
	-89.3 million	-88.8 million

**Federal Government share equals approximately 500,000.

These costs are present costs and do not contain an inflation factor. Actual housing costs are not included in the above analysis since they are recoverable costs by the developer and are not classed as municipal infrastructure costs.

However, it is assumed that the mortgage financing required would be provided by the Alberta Housing Corporation. Since conventional mortgage sources are limited at this time the costs involved become relevant. It is probable that total investment when the cost of housing is included would exceed $200 million. Therefore, approximately $150 million of mortgage financing must be provided.

Utilization of Existing Towns & Villages

-- it does not appear that any substantial saving over the above mentioned costs for a "new town" would be realized;

-- the existing communities all possess a minimal amount of infrastructure and facilities and would require a massive investment of public funds to reach the level of service required.[1]

[1]Department of Muhicipal Affairs, Appendix I, page 3.

-- if more than one centre was allowed to grow, the costs would probably be even greater than those mentioned above;

-- there are also significant social costs through disruption of the daily life of small communities.

Time Frame for Development

-- it is unlikely that it will be possible to get the required infrastructure in place before 1980, i.e. two years after the proposed petrochemical plants would come on stream.

Ability of the Department of Municipal Affairs to Cope with New Developments

It does not seem likely that the existing provincial planning structure can adequately deal with the rapid development forecast for these new towns. A new more fully integrated approach involving resource management, regional planning and community planning may be a necessity and may require new legislation.

NOTE: It should be noted that the 16,000 people which it is estimated would live near a petrochemical site, represents about 80% of the recent average annual growth of the City of Edmonton.

LABOR FACTORS

- Labour Market Considerations in the Skaro Area

  - If the petrochemical complex is located in the Skaro area, the immediate sources of labour would logically be the 10-30 mile radius within the area. The following centres are located in this vicinity: Bruderheim, Redwater, Radway, Smoky Lake, Warspite, Waskatenau, Lamont and Andrew.
  - The total population in these eight centres (1971 census) is 4,400 with 67% in the twenty years and over, age group.
  - In these eight centres, unemployment is minimal. There is in fact zero unemployment in Bruderheim, Radway, Waskatenau and Andrew.
  - Specialized skills required by the petrochemical complex during the operations phase (47% engineers, technologists & technicians) will have to be attracted to the Skaro area. The 1971 census showed that 20% of the population age 15 and over had Grade 4 or less and that the experienced labour force consists mainly of workers in community business and personal services related to agriculture and farming.

- Labour Market Conditions in the Construction Stage

  - The supply of construction labour for the petrochemical project and related infrastructure requirements will be tight during the next three years due to the high level of industrial activity in the Province.
  - It is estimated that the 1.2 billion lb. ethylene plant and associated derivatives will require over 7,000 man years work. This constitutes an average of 2 per cent of the total construction labour demand in the province between now and 1978.
  - It is estimated that the construction labour force required for town development will be as much as 5,000 man years.
  - The construction of the petrochemical project would require either a camp or a "bus-in" system.
  - Setting up work camps would mean direct competition with the oil sands for the mobile construction labour force and other "camp-type" workers in the province.
  - A "bus-in" system would allow direct accessing of the Edmonton labour pool without costly competition with the oil sands, i.e. wages, fringe benefits, camp facilities, etc.
  - To minimize delays in construction, project contractors may have to seek overtime permits to allow longer working hours, i.e. 48 to 60 hour weeks.
  - The competition for labour in a supply constrained market, the current high levels of inflation, and the upcoming negotiation of a new agreement for the building and construction trades in Spring, 1975, will have serious implications on the wage costs of the petrochemical project.

Supporting Documents (See Chapter Seven, Volume II for the following:)

-- Letter from Mr. R. Erickson, Department of Municipal Affairs "Alberta Petrochemical Industry Proposal. Municipal Development".

-- "Alberta's Recommended Municipal Development Policy" (Municipal Affairs).

-- Comparison of Municipal Costs between Edmonton and Skaro.

-- "Population and Labour Force Characteristics of Skaro Area" (Manpower & Labour).

CHAPTER EIGHT

ECONOMIC EFFECTS

Total Economic Impact

-- During the construction phase of the petrochemical complex $418 million dollars will be spent in Alberta. Through the economic multiplier this will result in a total increase in income of $940 million dollars or approximately $210 million per year from startup to mid 1979.

-- The annual expenditure of the complex in the form of purchased goods and services in Alberta will be $107 million dollars. Through the multiplier this expenditure will generate $240 million dollars per year.

-- Because of the opportunities for third stage derivative operations associated with the growth of the petrochemical complex in Alberta, the economic multiplier could be expected to increase from a historical figure of 2.25 to something in the order of 4 - 5.

Net Benefits

-- The net benefit to Albertans of having the petrochemical industry development in Alberta will be in the order of $6 million dollars per annum. The figure is the net gain associated with new opportunities for Albertans relative to existing employment and income generating opportunities.

-- The new opportunities associated with the complex are the hoped for benefits that could accrue to the province.

-- The better employment opportunities and the broadening of the industrial base will provide benefits in the form of a more stable economy.

Net Costs

-- Because of the need to establish the industry in Alberta, a real cost in the form of direct support to the ethylene producers could range from a single payment of $22 million dollars in the first year to an average yearly payment of $14 million per year for the first eight years. This range of assistance is based on two forecasts of Gulf Coast ethylene prices and an Alberta gas price of 81¢ per MCF in 1978.

-- Because the environmental requirements have tended to push pollution costs onto the firm, the net costs from this area would tend to be lower, than heretofore.

Net Government Revenue Generated

-- It is expected that additional Provincial Government revenue associated with the complex due to various forms of taxation will be about $31 million per annum: This is broken down as follows:

(a) Corporate income tax $16 million per annum
(b) Income tax of operational personnel, $1.4 million per annum
(c) Income tax associated with multiplier activity

i) corporate income tax $2.3 million per annum
ii) gasoline and fuel tax $2.7 million per annum
iii) personnel income tax $9.3 million per annum

-- Total municipal taxes will amount to about $1.5 million per annum

Supporting Documents

-- The foregoing conclusions are supported in greater detail, in Chapter Eight, Volume II.

CHAPTER NINE

THE ALBERTA LABOUR SITUATION

Current proposals for major industrial consruction activity in Alberta for the period 1974 to 1980 can be summarized as follows:

- three ethane extraction plants and Cochin pipeline
- two 1.2 billion lb/yr. ethylene plants and associated derivative plants
- four approximately 120,000 bbls/day oil sands extraction plants
- three conventional oil refineries
- three (or more) ammonia/urea fertilizer plants
- two methanol plants
- two "chemical" refineries
- five electric utility plants
- five coal mines
- steel plant complex
- five pulp/paper mills

Several of these projects (i.e. ethylene plants, oil sands extraction plants) are essential to Alberta's industrial policy. Some (e.g. coal mines) are necessary to meet Alberta's national responsibilities, while others result from normal commercial expansion (e.g. oil refineries, electrical utility plants). However, others (e.g. fertilizer plants, methanol plants, pulp mills) if allowed to proceed, may prejudice the timely completion of the more important projects.

Consequently, there is a need to establish some priorities in order to provide guidance for planning the orderly growth of the Province's industrial development.

Supporting Documents:

- see Chapter Nine, Volume II
- "The Construction Industry - Activity - Labour Demand & Supply" (Manpower and Labour)
- letter from Mr. E. J. White dated October 24, 1974 "Pulp & Paper Mill Project Estimates to 1980"